Virtual Project Management Challenge

November 17, 2015

Today on the VPMC

Why Don't They Just Give Us Money?
Project Cost Estimating and Cost Reporting

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Tuesday, November 17, 2015
2:00 p.m. – 3:30 p.m. EST
Learn more: http://www.nasa.gov/offices/oce/pmchallenge

Project Cost Estimating

Doug Comstock
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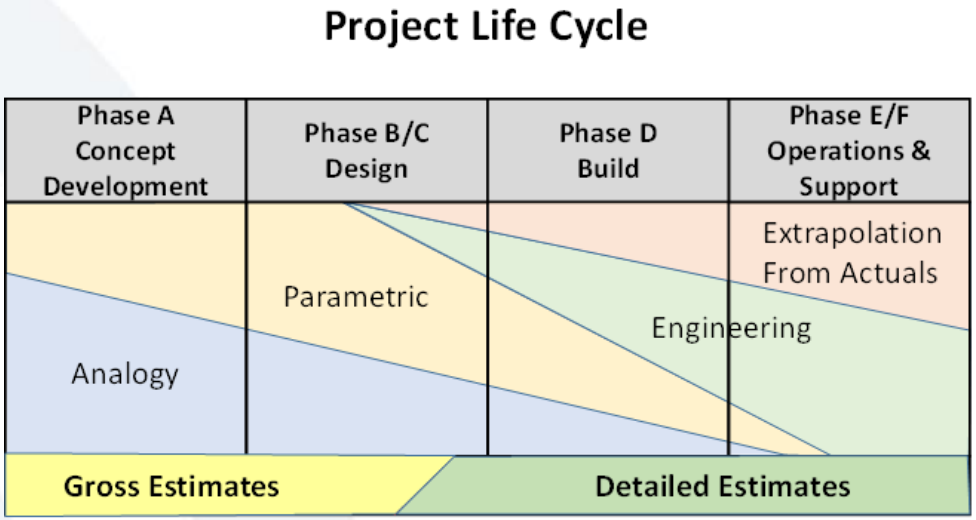
What is Cost Estimating?

- **A cost estimate is the summation of individual cost elements, using established methods and valid data, to estimate the future costs of a program, based on what is known today. *(GAO)***
- **Cost estimating is a fundamental activity that is essential throughout the life cycle of a well managed project.**

The Agency needs estimates for Project Office formulation and implementation phases, non-advocate cost estimates, source selections, what-if exercises, affordability studies, economic analyses, and Analysis of Alternatives (AoA), as well as to support numerous types of decisions related to projects.

(NASA CEH)



Why is Cost Estimating important?

- **Planning what the agency can do within available resources**
  - ✓ Informing the budget planning process
- **Shaping what can be undertaken towards achieving objectives for a particular project within available resources**
  - ✓ Making tradeoffs on affordability for requirements and options
- **Making commitments to our stakeholders for how much things will cost, and being held accountable**
  - ✓ Ensuring commitments have an acceptable level of risk
- **Taxpayers (and their elected representatives) care what things will cost**
  - ✓ It's their money we're spending
- **Delivering on commitments the Agency makes is critical to strengthen credibility with our stakeholders**
  - ✓ We are entrusted with being responsible stewards

What are the Challenges?

- **NASA is usually building one of a kind machines to do things that have never been done before!**

If we want projects to meet cost and schedule commitments, we must understand their risks and fund them at a level commensurate with the amount of risk we are willing to accept.

Why not use a Point Estimate?

- **Is the "point" estimate equal to …**

  The "most Likely" or "most probable" cost? The 50th-percentile cost? The expected cost?

- **No – It is not likely to be equal to any of these and there are, in fact, a range of possible costs**
  - If the "point" estimate is the "most likely" cost, other cost levels can be assumed to be "less likely"
  - If the "point" estimate is the "50th percentile" cost, then there are cost levels at other percentiles
  - If the "point" estimate is the "expected" cost, then other cost levels are presumably "unexpected"

- **Project managers need "Point Estimates" for …**

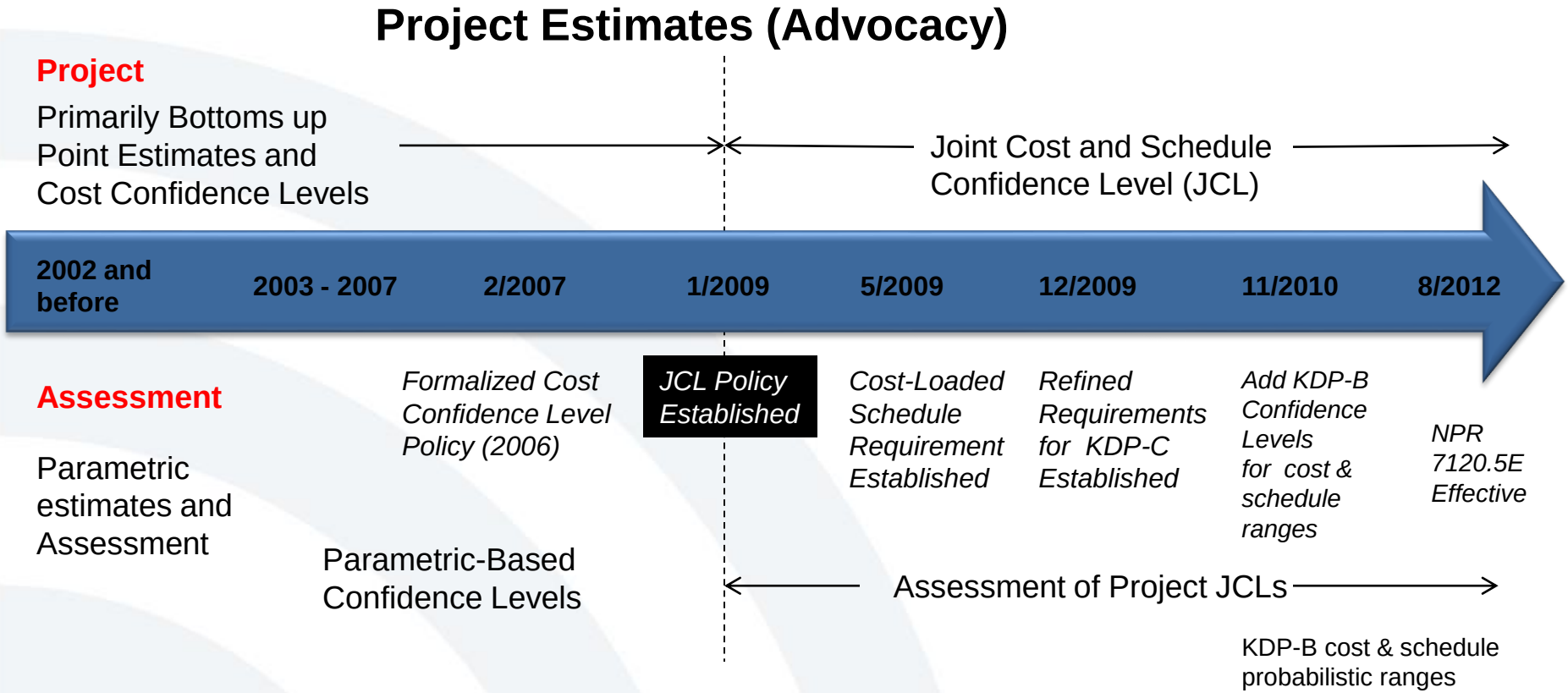
  Cost/performance tradeoff studies Cost/benefit analyses Budget Planning

- **But a project "point" estimate is often nebulous due to …**

Immature technology – TRL assumed higher then it is	Programmatic and organizational considerations
Uncertain product design	Schedule slips due to integration difficulties and test failures
Software-associated issues	Changes in budget environment
Requirements volatility	Unforeseen events

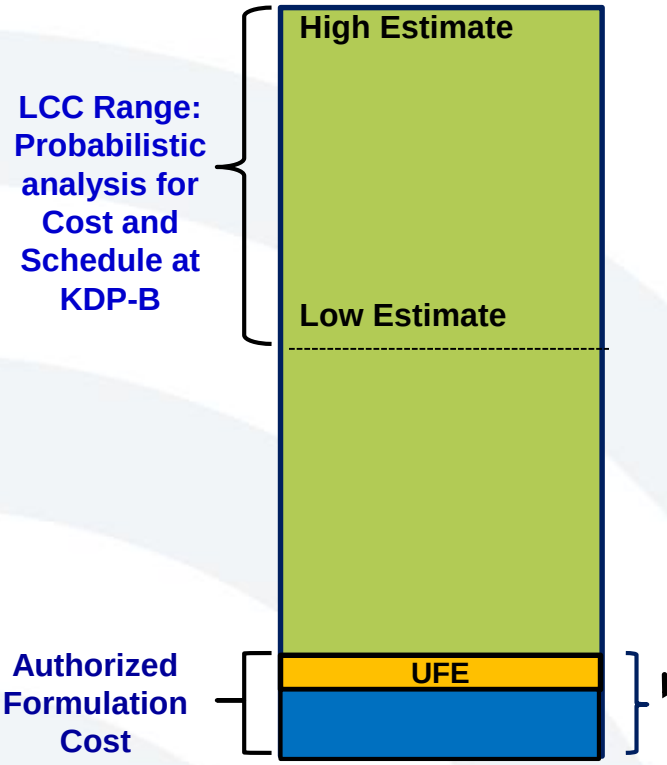
- **While "point" estimates are not "correct", "actual" Project cost will typically fall within some range (with some degree of confidence)**
  - The best we can hope to do is to understand the amount of uncertainty
  - Understanding the uncertainty will help us make provision for it

Evolution of NASA Cost Policy



NASA's Cost Policy has evolved to address the challenges associated with a point estimate and now requires a probabilistic, integrated assessment of cost, schedule and risk.

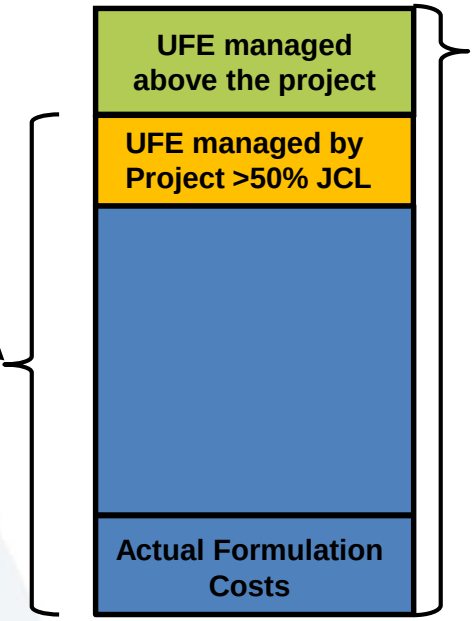
NPR 7120.5E Cost Framework



Agency Baseline Commitment (ABC)

- 70% JCL for Cost and Schedule
- External Commitments

Management Agreements



Life cycle cost estimate

At KDP C and subsequent Agency Baseline Commitment rebaselines the ABC and the life cycle cost estimate are equal.

During Formulation | **KDP-C** | **During Implementation**

Five –year budget run out and schedule estimates are reported to Congress. If a project signs a contract > $50 M, LCC range is reported to OMB. For selected projects, LCC and schedule ranges are reported to GAO.

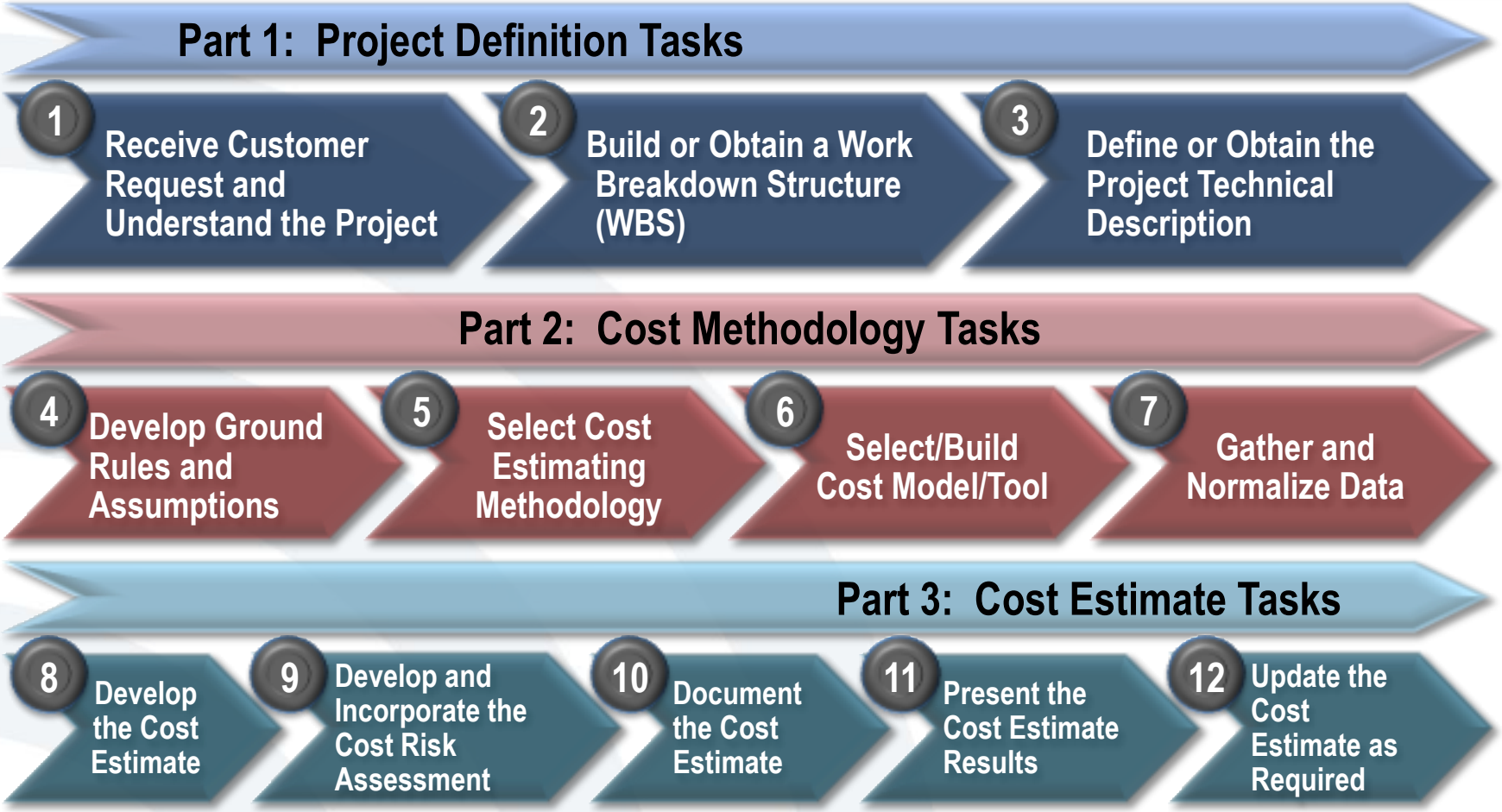
Notional and Not to Scale

From this point, Congress, OMB and GAO get detailed cost and schedule information. All changes are tracked back to the ABC.

So how do I estimate my costs?

- **NASA has experts in cost estimating across the agency to help you develop a cost estimate.**
- **Contact them for assistance:**
  - ARC: Tommy Paine
  - AFRC: Steve Sterk
  - GRC: Bob Sefcik
  - GSFC: Steve Shinn or Anthony McNair
  - JPL: Fred Doumani
  - JSC: Vickie Gutierrez
  - KSC: Sandeep Wilkhu or Glenn Butts
  - LaRC: Debra Schroeder
  - MSFC: Andy Prince
- **You can always contact CAD and we can help.**

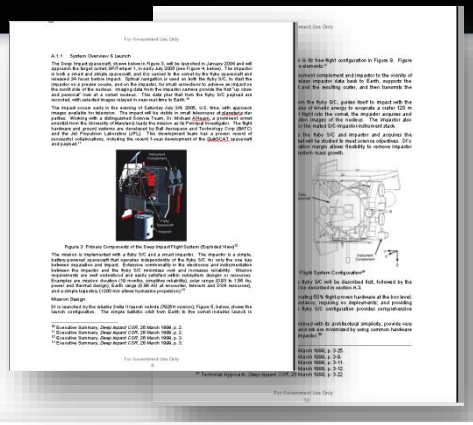
What does a Cost Estimator do?

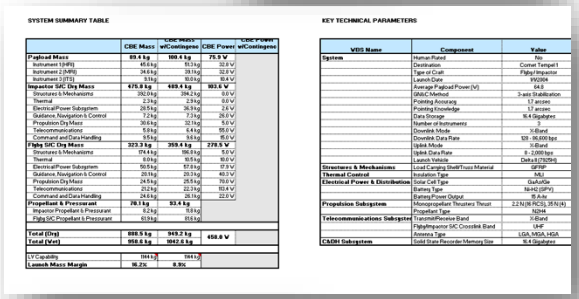


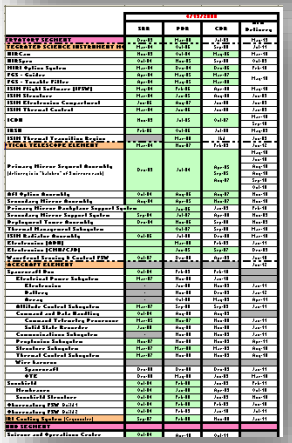
NOTE: While laid out in linear sequence, the process in practice is very iterative.
Source: NASA Cost Estimating Handbook v4.0

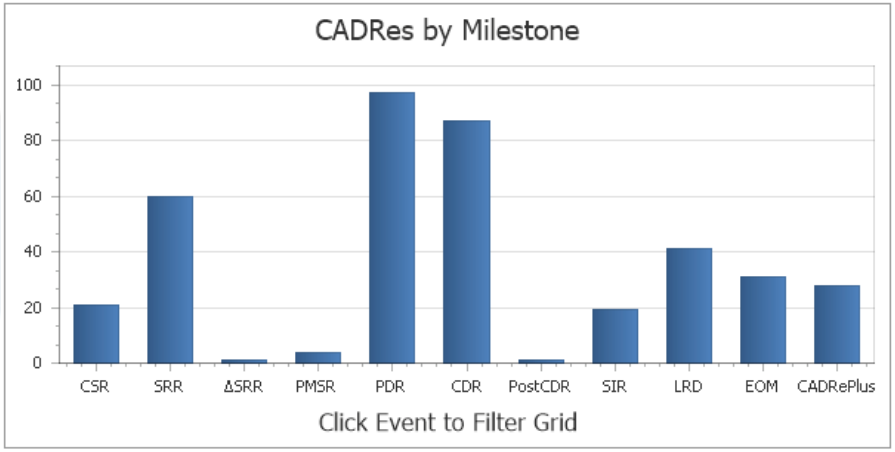
What is the source of Data?

- **Cost Analysis Requirements Document (CADRe) is a 'Flight Data Recorder'** that captures the project status at each milestone (SRR, PDR, CDR, SIR, Launch, etc)
  - **PART A** Describes a NASA project and significant changes that have occurred since the last milestone
  - **PART B** Capture key technical parameters including margins (Mass, Power, Data Rates, etc.)
  - **PART C** Captures the project's Cost Estimate and actuals to date by Work Breakdown Structure (WBS)



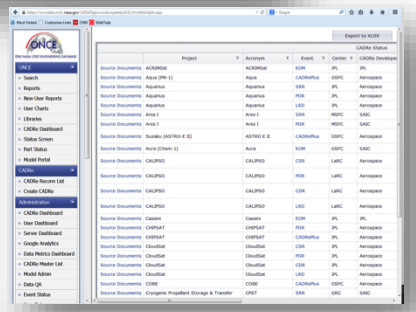


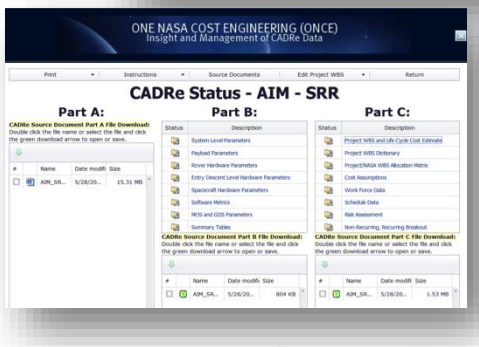




How is the Data Accessed?

- **One NASA Cost Engineering (ONCE) Database**
  - ✓ Located at www.ONCEDATA.com ONCE is a government website managed by HQ CAD that provides access to technical, cost, and other programmatic information about NASA Projects.
- **The data comes from CADRe documents**
- **The website provides a user interface to search and retrieve data from the CADRe's**
  - ✓ Enables analysts and estimators to quickly build analogy datasets, perform historical analysis, develop cost estimating relationships, etc.
- **Users can output the data retrieved from ONCE to MS Excel for their own specific analysis needs**
  - ✓ Project estimation, independent estimation, research, proposal development, etc.
- **ONCE also has a model portal that makes key cost estimating tools available to the community.**





Cost Estimating Done Well

- **What will good cost estimating do for your project?**
  - ✓ Gives you a better understanding of how design trades and risks impact project cost.
  - ✓ Identifies drivers that may have the most impact on cost or schedule, which can help focus management attention and prioritize risk mitigation efforts.
  - ✓ Systematically integrates cost with schedule and risk products and processes to provide a cohesive and holistic picture of the projects ability to achieve cost and schedule goals.
  - ✓ Establishes a realistic estimate and commitment that can be executed with appropriate cost and schedule margins to handle risk and uncertainty.

Lack of Effective Estimating

- **If your project does not have good estimates, you increase the risk of overruns and delays.**
  - ✓ Cost overruns may lead to descopes, cancellation or rebaselining of your project.
  - ✓ Status is reported to stakeholders, and overruns can damage trust in the Agency's ability to deliver on commitments and invite more external scrutiny.
  - ✓ Cost overruns may require reallocation of resources from other projects, degrading the health of the broader portfolio and reducing efficiency and throughput.

Things to Know

- Experts stand ready to help
- Cost estimating is done throughout the life cycle of a project and can help inform your decisions
- Good estimating integrates cost, schedule and risk
- A Basis of Estimate is not “what’s in the budget wedge”
- A point estimate is necessary but not sufficient
- A good and standard Work Breakdown Structure is critical
- CADRe/ONCE captures data for all projects and is a critical resource for Data Driven analysis
- JCL is not a four letter word
- Schedule and cost are interdependent
- Risk and Uncertainty are real and must not be ignored
- The future is difficult to predict with precision, but a knowledgeable analyst equipped with good data and tools can develop a good understanding of probable outcomes

Learn More about JCL

Charles Hunt
Analyst for NASA Headquarters, Cost Analyst Division

Session 4: JCL Journey: A Look into NASA's Joint Cost and Schedule Confidence Level Policy

August 15, 2013

NASA has been implementing Joint Cost and Schedule Confidence Level (JCL) since 2009. JCL policy, as written in NPR 7120.5E, states that projects are required to perform a JCL with the intent that they demonstrate a 70% probability that cost will be equal to or less than the targeted cost and schedule will be equal to or less than the targeted schedule date. View more

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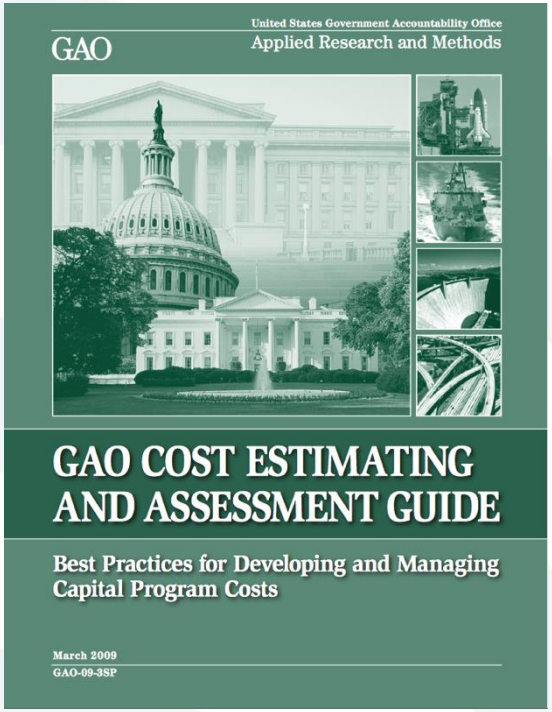
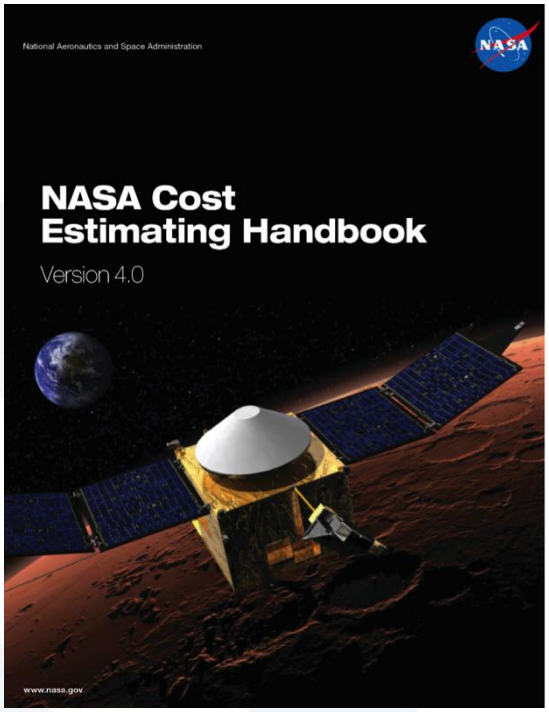
http://www.nasa.gov/offices/oce/pmchallenge/sessions/2013_Session_4_abstract.html

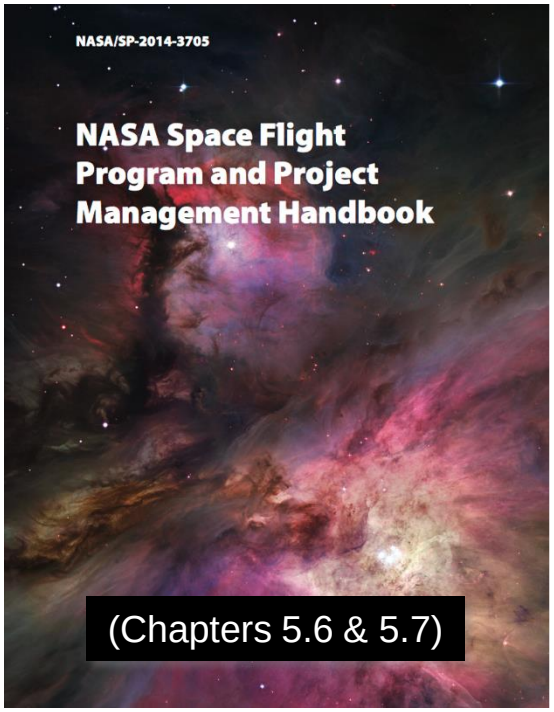
Additional Key Resources



http://www.gao.gov/new.items/d093sp.pdf



https://www.nasa.gov/offices/ooe/CAD/nasa-cost-estimating-handbook-ceh



http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20150000400.pdf

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Project Cost Reporting

Mary Beth Zimmerman
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Cost Reporting: What is it and why is it important?

Project	Base Year	JCL (%)	Development Cost Estimate ($M)		Cost Change (%)	Key Milestone	Key Milestone		Schedule Change (months)
			Base	2015			Base	2015	
EGS-GSDO*	2015	80	1,843.5	1,843.5	0	Launch Readiness for EM-1	Nov 2018	2018	0
GRACE FO	2015	70	264.0	262.8	0	LRD	Feb 2018	Feb 2018	0
ICESat-2**	2015	70	763.7	763.7	0	LRD	Jun 2018	Jun 2018	0
ICON	2015	70	196.0	196.0	0	LRD	Oct 2017	Oct 2017	0
InSight	201	70	541.8	541.8	0	LRD	Mar 2016	Mar 2016	0
Webb	2012	66	6,197.9	6,190.4	0	LRD	Oct 2018	Oct 2018	0
MMS	2010	70	857.3	884.5	3	LRD	Mar 2015	Apr 2015	1
OSIRIS-REx	2014	70	778.6	709.7	-9	LRD	Oct 2016	Oct 2016	0
SGSS	2013	70	368.1	Under Review	N/A	FAR	Jun 2017	Under Review	N/A
SLS	2015	70	7,021.4	7,021.4	0	Launch Readiness for EM-1	Nov 2018	Nov 2018	0
SMAP	2013	>70	485.7	479.0	-1	LRD	Mar 2015	Mar 2015	0
SOC	2014	N/A	376.9	320.0	-15	LRD	Oct 2018	Oct 2018	0
SPP	2015	70	1,055.7	1,055.7	0	LRD	Aug 2018	Aug 2018	0
TESS	2015	70	323.2	296.4	-8	LRD	Jun 2018	Jun 2018	0

How is risk informed cost estimating related to budget?

What are the challenges of effective cost reporting?

How can project managers provide expected cost reporting?

What is baselining all about?

When it’s done well, what does cost reporting do for a project?

When it's not done well, how does project cost reporting look?

Kristin Van Wychen

Senior Analyst,
US Government Accountability Office

Putting It All Together

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Project Management Truisms

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"Manage as you budget and budget as you manage."

“Baselining is forever.”

"Things are more likely to go wrong than not."

“Budget for what you can’t see.”

“Time is money.”

Q&A Session

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